

No. RW/NHVI-67(5)/74

Dated the 30th April, 1986

To

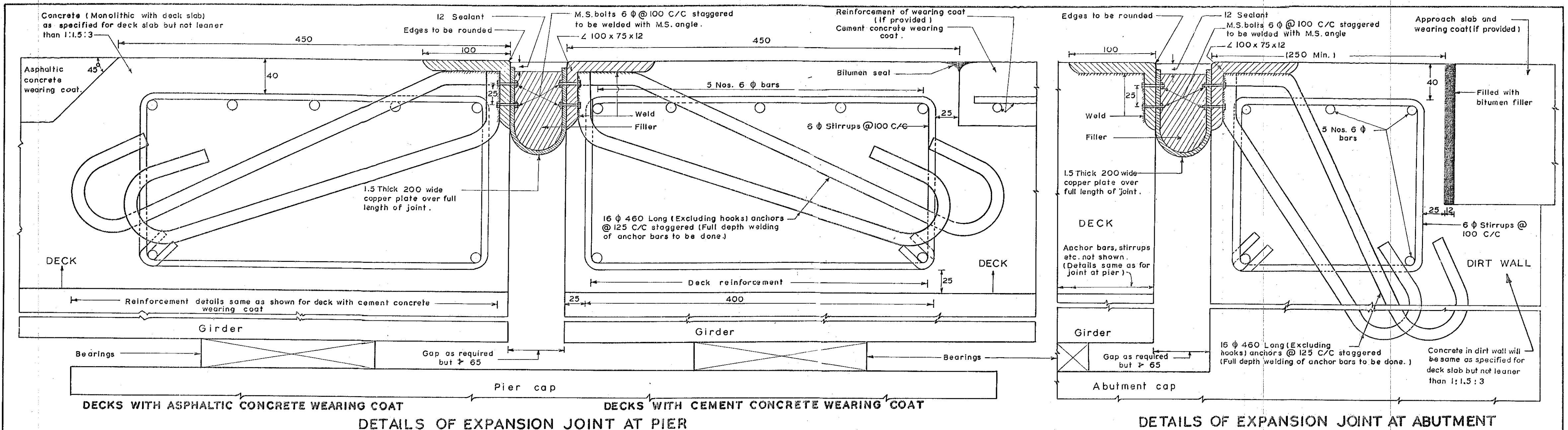
1. The Chief Engineers of States and Union Territories PWDs dealing with National Highways and other Centrally Financed Roads.
2. The Director General (Works), Central PWD.
3. The Director General Border Roads.

Subject: Standard Drawing for expansion joints for use in bridges on National Highways and under other Centrally Financed Schemes.

It has been brought to our notice that the performance of expansion joints for bridge decks as shown in the Ministry's Standard Drg. No. BD/1-69B has not been satisfactory and certain improvements in the details/specifications of expansion joints are called for. A research scheme has been taken up to evolve improved type of expansion joints and to suggest new fillers and sealant materials which are suitable to the particular requirements in our country. It is, however, felt that the recommendations of the above mentioned Scheme are not likely to be available in the near future.

2. Keeping in view the desirability of adopting an improved type of expansion joints, it has been decided to reissue our Standard Drg. No. BD/1-82 (slightly modified to BD/1-82A) for use in bridges on NHs and under other Centrally Financed Schemes till such time that the findings of the Research Scheme are available. Accordingly, it is requested that the above-mentioned Drg. No. BD/1-82A may kindly be adopted till further communication from the Ministry in this regard. This supersedes Standard Drg. No. BD/1-69B.

3. The above Drawing is suitable for a maximum gap width of 65 mm. However, where expected movements are small (like those in solid slab bridges upto 10m. span), the details of expansion joints shown in the Ministry's Standard Drg. No. BD/1-74 may please be used. A copy of Standard Drawing No. BD/1-82A is enclosed herewith. In case more copies are required for circulation to the lower formations, the same may please be got prepared from the tracings made at your end.



NOTES:-

I-GENERAL

- THE DETAILS SHOWN IN THIS DRAWING ARE SUITABLE FOR MAXIMUM GAP OF 65mm.
- WHERE MOVEMENTS ARE SMALL LIKE IN SLAB BRIDGES UP TO 10m SPANS, THIS TYPE OF EXPANSION JOINT SHALL NOT BE PROVIDED. IN SUCH CASES EXPANSION JOINT SHOWN IN THE STANDARD DRAWINGS FOR SLAB BRIDGES AS IN DRG. NO. BD/1-74 SHALL BE PROVIDED.
- THE ENTIRE ANGLE IRON ASSEMBLY SHALL BE SHOP FABRICATED WITH CAMBER CORRESPONDING TO THAT OF THE WEARING COAT. THIS MAY BE ACHIEVED PREFERABLY BY ADOPTING ONLY ONE PIECE, AND IN CASE OF DIFFICULTY, BY ADOPTING TWO SEPARATE PIECES.
- THE WEARING COAT NEAR THE EXPANSION JOINT, SHOWN MONOLITHIC WITH THE DECK SLAB, SHALL BE CAST TO TRUE SHAPE AND CAMBER ALONG WITH THE DECK SLAB.
- THE HEIGHT OF THE STIRRUP REINFORCEMENT SHALL BE SUITABLY ADJUSTED ACCORDING TO THE DEPTH OF THE DECK TO MAKE USE OF THE DECK REINFORCEMENT FOR ANCHORING THE STIRRUP REINFORCEMENT.
- IN AREAS PRONE TO CORROSION, THE ANGLE-IRON SHALL BE GALVANISED.
- THE REINFORCEMENT DETAILS SHOWN IN THIS DRAWING ARE IN ADDITION TO THE STRUCTURAL REINFORCEMENT IN DECK SLAB.
- THE DETAILS SHOWN IN THIS DRAWING SUPERSEDE THOSE IN DRG. NO. BD/1-69.
- ALL DIMENSIONS ARE IN MILLIMETRES. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.

II DESIGN

- THE GAP WIDTH OF THE JOINT SHALL BE CALCULATED AS PER DETAILS GIVEN LATER UNDER SUB-HEAD CALCULATIONS.
- THE MAXIMUM COMPRESSION OF THE FILLER SHALL BE LIMITED TO $1/3$ RD. OF THE UNCOMPRESSED THICKNESS.
- THE MAXIMUM WIDTH OF GAP BETWEEN THE ANGLE IRONS SHALL NOT EXCEED 65mm.
- THE OPEN GAP TO BE PROVIDED AT THE TIME OF POSITIONING OF THE EXPANSION JOINT ASSEMBLY AND CASTING OF THE DECK SHALL BE CALCULATED BY CONSIDERING THE MAXIMUM POSSIBLE MOVEMENT BETWEEN THE EXTREME DESIGN TEMPERATURE AND THE AMBIENT TEMPERATURE AT THE TIME OF CASTING (SEE CALCULATIONS).
- THE ANCHOR BARS ATTACHED WITH THE ANGLE IRONS SHALL BE SHOP WELDED AND SHALL DEVELOP THE FULL STRENGTH OF THE BARS. SHAPE OF ANCHOR BARS MAY BE SUITABLY MODIFIED DEPENDING UPON SLAB THICKNESS AND OTHER DETAILS.

III SPECIFICATIONS

- CONCRETE : AS PER APPROVED SUPERSTRUCTURE DESIGN BUT NOT LEANER THAN 1:1.5:3.
- ASPHALTIC CONCRETE: AS PER IRC: 29-1968.
- BITUMEN FILLER : AS PER RELEVANT I.S. SPECIFICATIONS.
- SEALING COMPOUND : AS PER RELEVANT I.S. SPECIFICATIONS.
- STRUCTURAL STEEL WORK: AS PER I.R.C.: 24-1967.
- COPPER PLATE : AS PER I.S. 1972-1961.

IV INSTALLATION INSTRUCTIONS

- THE ANGLE IRON ASSEMBLY SHOULD BE CAREFULLY LEVELLED AND KEPT IN POSITION AT WEARING COAT LEVEL WITH PROPER GAP WIDTH BEFORE CASTING THE DECK. THE REINFORCEMENT OF THE JOINT SHALL ALSO BE PLACED IN POSITION BEFORE CASTING THE DECK SLAB.
- SINCE THE PERFORMANCE / PROPER FUNCTIONING OF AN EXPANSION JOINT DEPENDS LARGELY ON THE QUALITY OF WORKMANSHIP AND THE ACCURATE INSTALLATION OF ANGLE IRON ASSEMBLY, IT IS NECESSARY THAT THE PLACEMENT AND FIXING OF JOINT IS PERSONALLY SUPERVISED BY THE ENGINEER-IN-CHARGE.
- IT IS ESSENTIAL THAT THE ANCHORS ATTACHED TO THE ANGLE IRONS ARE PROPERLY EMBEDDED IN WELL COMPACTED CONCRETE FOR ENSURING ADEQUATE BOND. THEREFORE, THE CONCRETE IN THE DECK SHALL BE PROPERLY PLACED AND VIBRATED BY NEEDLE VIBRATORS SO THAT NO VOIDS ARE LEFT BEHIND THE ANGLE IRON ASSEMBLY.
- THE GAP WIDTH TO BE PROVIDED IN THE EXPANSION JOINT SHALL BE ADJUSTED ACCORDING TO AMBIENT TEMPERATURE.
- THE GAP SHOULD BE CLEANED THOROUGHLY OF ALL FOREIGN MATTER BEFORE THE FILLER AND SEALANT ARE PLACED IN POSITION. AS THE UNCOMPACTED THICKNESS OF FILLER MAY EXCEED THE GAP WIDTH AT THE TIME OF PLACEMENT, ARRANGEMENT SHOULD BE MADE TO PLACE IT IN A PRECOMPRESSED CONDITION.
- THE SEALANT SHALL BE SO POURED THAT AT THE TIME OF MINIMUM GAP IT DOES NOT OVERFLOW.
- THE EXPANSION JOINT SHALL BE LAID AT THE COLDEST TEMPERATURE AS FAR AS POSSIBLE.

V MAINTENANCE

A. JOINT FILLER AND SEALANT

THE JOINT FILLER AND SEALANT HAVE A LIMITED LIFE. IT IS ESSENTIAL THAT AT REGULAR INTERVALS, THESE MATERIALS ARE THOROUGHLY INSPECTED AND IF THESE ARE FOUND TO HAVE BECOME HARD AND NOT FUNCTIONING PROPERLY, THESE SHALL BE REPLACED FOR THIS PURPOSE, THE FOLLOWING IS SUGGESTED.

- THE INSTRUCTIONS OF THE MANUFACTURER OF THE SEALANT AND THE FILLER ABOUT THEIR LIFE SHALL BE NOTED IN THE MAINTENANCE RECORDS.
- AT LEAST ONCE IN A YEAR, PREFERABLY BEFORE THE SUMMER SEASON, THE SEALANT AND FILLER MATERIAL SHALL BE CHECKED BY THE ENGINEER-IN-CHARGE.
- IN CASE THE SEALANT AND FILLER NEED TO BE REPLACED, THIS MUST BE DONE BEFORE THE SUMMER, SO THAT FREE MOVEMENT OF THE STRUCTURE IS ASSURED.
- IN CASE THE SEALANT IS OVER FLOWING, THE EXCESS SHOULD BE SCRAPPED AND DISCARDED.

B. ASPHALTIC CONCRETE (FOR DECKS WITH ASPHALTIC CONCRETE WEARING COAT)

WEARING COAT SHALL ALWAYS BE MAINTAINED AT LEVEL TO AVOID ANY UNDUE SHOCK TO EXPANSION JOINT ASSEMBLY. IT SHALL NOT FLOW NEAR THE EDGES AND DEVELOP A DEPRESSION. WHEREVER IT OVER FLOWS, THE TOP 15mm. TO 25mm. OF THE MATERIAL SHALL BE REMOVED AND REFILLED WITH FRESH MATERIAL AND FULLY COMPACTED.

VI CAUTION NOTE

- IT IS ESSENTIAL THAT MATERIALS SATISFYING THE PROVISIONS OF RELEVANT STANDARDS ONLY ARE USED AS A FILLER OR SEALANT.
- USE OF ANY OTHER MATERIAL LIKE SAND MASTIC ETC. SHALL BE COMPLETELY AVOIDED.
- THIS JOINT IS RECOMMENDED FOR USE WHERE VERTICAL MOVEMENTS UP TO ABOUT 10mm ARE EXPECTED.
- FOR SEALING MATERIALS AND FILLERS, MANUFACTURER'S ADVICE SHOULD BE FOLLOWED REGARDING PREPARATION OF JOINT SURFACES, THE METHOD OF APPLICATION, AND THE WIDTH:DEPTH RATIO OF THE SEALING MATERIALS.
- THE BEARINGS BELOW THE GIRDERS SHALL BE SET AS CLOSE TO THE GIRDER ENDS AS POSSIBLE TO REDUCE THE EFFECTS DUE TO ROTATIONAL MOVEMENTS.

VII CALCULATIONS

- THE WIDTH OF THE GAP SHALL BE WORKED OUT CONSIDERING THE RESIDUAL CREEP, SHRINKAGE, ELASTIC SHORTENING OF THE GIRDER, MOVEMENT OF THE BEARING, MOVEMENT DUE TO SUPERSTRUCTURE (IF ANY), MOVEMENT DUE TO TEMPERATURE, ETC.
- THE MOVEMENT DUE TO TEMPERATURE CHANGES SHALL BE CALCULATED AS PER CLAUSE 218 OF IRC-6-1966.
- CALCULATIONS FOR THE GAP TO BE PROVIDED AT THE TIME OF SETTING THE EXPANSION JOINTS.

- LET THE WIDTH OF GAP REQUIRED TO BE PROVIDED AT THE TIME OF INSTALLATION BE X mm.
 - AMBIENT TEMPERATURE AT THAT TIME $t^{\circ}\text{C}$
 - MAXIMUM TEMPERATURE TO BE PROVIDED FOR $T_1^{\circ}\text{C}$
 - MINIMUM TEMPERATURE TO BE PROVIDED FOR $T_2^{\circ}\text{C}$
 - LIKELY DROP OF TEMPERATURE AT THE TIME OF INSTALLATION $=(t-T_2)^{\circ}\text{C}$
 - SPAN LENGTH L METRES $\times 1000$ L mm.
 - COEF. OF LINEAR EXPANSION $\alpha^{\circ}/^{\circ}\text{C}$
 - DECK SHORTENING DUE TO TEMPERATURE DROP $= 1000 L \alpha (t-T_2)$ mm.
 - SHORTENING DUE TO OTHER CAUSES SUCH AS SHRINKAGE, CREEP, ELASTIC SHORTENING $= S$ mm.
 - DISTORTION IN BEARINGS DUE TO EXTERNAL FORCES $= d$ mm.
 - TOTAL SHORTENING LIKELY TO TAKE PLACE AFTER INSTALLATION $=(d+S+1000 L \alpha (t-T_2))$ mm.
 - MAXIMUM WIDTH OF GAP CORRESPONDING TO POSITION 'K' $= [X+S+1000 L \alpha (t-T_1)+d]$ mm.
 - PROBABLE INCREASE IN TEMPERATURE ABOVE THE AMBIENT TEMPERATURE $=(T_1-t)^{\circ}\text{C}$
 - EXPANSION OF DECK DUE TO RISE IN TEMPERATURE $= 1000 L \alpha (T_1-t)$ mm.
 - MINIMUM WIDTH OF GAP UNDER MAXIMUM TEMP. $= [X+S-d-1000 L \alpha (T_1-t)]$ mm.
- CONDITIONS TO BE FULFILLED:-
- THICKNESS OF FILLER $f \geq$ MAX. WIDTH OF GAP GIVEN IN (L)
 - DIFFERENCE BETWEEN MAX. AND MIN. GAP $\leq 1/3$
 - MAXIMUM GAP ≤ 65 mm.
 - f CAN BE WORKED OUT FROM (L), (O) AND (ii) ABOVE
 - X CAN THEN BE DETERMINED FROM (L) AND (iv) ABOVE.

4. EXAMPLE

GIVEN SPAN 20 m.
 MAXIMUM TEMPERATURE 40°C
 MINIMUM TEMPERATURE 6°C
 AMBIENT TEMPERATURE 25°C
 $\alpha = 0.0000117 / ^{\circ}\text{C}$
 SHORTENING DUE TO SHRINKAGE ETC. $= 3$ mm
 MOVEMENT AT BEARINGS DUE TO HORIZONTAL FORCES $= 2$ mm.
 LET THE GAP TO BE PROVIDED AT THE TIME OF INSTALLATION $= X$ mm.
 MAXIMUM WIDTH OF GAP $= [X+3+2+1000 \times 20 \times 0.0000117 \times (25-6)]$ mm.
 $= [X+9.45]$ mm.
 MINIMUM GAP WIDTH $= [X+3-2-1000 \times 20 \times 0.0000117 \times (40-25)]$ mm.
 $= [X-2.51]$ mm.
 DIFFERENCE BETWEEN MAX. AND MIN. GAP = MOVEMENT TO BE PROVIDED FOR
 $= 11.96 = 12$ mm. SAY
 THICKNESS OF FILLER $= 12 \times 3 = 36$ mm (WHICH IS LESS THAN 65 mm.)
 \therefore PROVIDE THICKNESS OF FILLER $= 40$ mm.
 \therefore MAXIMUM GAP $= X+9.45 = 40$ mm.
 $\therefore X = 31.55$ SAY 31 mm.

REVISION	YEAR	DESCRIPTION	SIGNATURE
1.	APRIL 96	Description of concrete in dirt wall added.	S.E. (B) S/R
			C.E. (A) S/R

GOVERNMENT OF INDIA
 MINISTRY OF SHIPPING AND TRANSPORT
 ROADS WING, NEW DELHI.

STANDARD CONCRETE BRIDGES

DETAILS OF EXPANSION JOINT

RECOMMENDED BY:	RECOMMENDED BY:	MARCH, 1982
S.C. MEHROTRA, E.E.	R. S. SHARMA, E.E.	
APPROVED BY:	APPROVED BY:	DRG. No.
R. S. SHARMA, E.E.	S. SEETHARAMAN, C.E.	BD/1-82A.